Delaware River Basin Commission (DRBC)

Interstate compact: PA, NJ, NY, DE

Contact Information

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Program Description

The objectives of the Commission's biological monitoring program are presently focused upon the 200-mile long non-tidal Delaware River corridor:

1. Protection of high quality aquatic life uses in Water Quality Zones 1A through 1E of the Delaware River, from Hancock, New York to Trenton, New Jersey
2. Development of anti-degradation biological criteria based upon existing water quality
3. Definition of longitudinal changes in benthic community structure along the Delaware River corridor, to support decisions to maintain or improve water quality where necessary

DRBC and the National Park Service (NPS) have operated the Scenic Rivers Monitoring Program since the early 1980s. The Commission has never used biological criteria for 305(b) assessments or determinations of impairment, other than reports arising from fish-tissue toxics analysis and inference of aquatic life use attainment based upon water chemistry. Macroinvertebrate biocriteria were developed for DRBC's Special Protection Waters rules issued in 1990, but the criteria were later found to be based upon inconsistent and non-representative methods, and have not been used as envisioned during development of the Commission's anti-degradation policies.

With the launch of DRBC's Lower Delaware Monitoring Program in 1999, declaration of most of the non-tidal Delaware River as Wild and Scenic in 2000, and major efforts to update DRBC's comprehensive plan and water quality standards (applicable to most of the Delaware River), interest in DRBC's biomonitoring program was renewed. Meetings with state and local partners resulted in the decision that the Commission would bear the primary responsibility for biological monitoring of the Delaware River, while each state would regulate and monitor tributaries. With technical support and advice from NJDEP, PADEP, USGS, USEPA Region 3, NPS, and the Academy of Natural Sciences, DRBC set out to define goals, objectives, and methods for improving its biological assessment program for the river.

DRBC investigated large-river bioassessment methods and decided to wait for issuance of EPA's large-rivers guidance before launching large-scale monitoring in difficult habitats such as pools, rapids, and upper-estuarine reaches. In 2001, DRBC initiated an annual benthic survey in 2001 of wadeable riffle, run, and island margin habitats, to develop a benthic index of biological integrity for the non-tidal river. The annual August/September low-flow survey is narrowly defined to eliminate spatial and temporal variability, enabling site-to-site, reach-to-reach, and year-to-year comparison of results. By 2005, DRBC hopes to have enough data to create a low-flow benthic IBI (B-IBI) for wadeable portions of the Delaware River, and to apply the B-IBI to future 305(b) assessments and protection of existing water quality.

The Commission would like to monitor other assemblages in order to gain a more complete picture of the ecological integrity of the Delaware River, and to measure progress toward objectives defined by the Commission's comprehensive plan. DRBC is investigating methods to assess submerged aquatic vegetation, periphyton, fish, mussels, plankton, invasive exotic species, and ecological characterization of over 50 unique microhabitats observed in the river. These investigations have been scheduled on a rotating basis as special studies, though they are not used in use support and/or impairment determinations.

Within the next year, DRBC and the NPS will begin planning for tributary Boundary Control Point biomonitoring. DRBC will establish locations and methods to define existing water quality and create biological targets at each location for antidegradation purposes. With the river survey in progress, this is an appropriate next step in improving biomonitoring coverage and implementing antidegradation policies. DRBC is also moving away from doing taxonomy in-house due to a lack of both time and work space. The identification work from the annual river survey will likely be contracted out sometime in the near future.

Documentation and Further Information

Delaware River & Bay Water Quality Assessment, 2000 305(b) report: http://www.state.nj.us/drbc/2K305b_text.PDF

DRBC Annual Report 2000: http://www.state.nj.us/drbc/ar2000.htm

DRBC Quality Assurance Project Plan 2001 Update: http://www.state.nj.us/drbc/QAplanLDEL01.PDF

DRBC Publications homepage: http://www.state.nj.us/drbc/public.htm

2001 Biomonitoring Work Plan (contains numerous citations, including three reports on DRBC's 3-year bioassessment study, issued by the Academy of Natural Sciences, Patrick Environmental Research Center with recommendations on how best to proceed with update of biocriteria and implementation of antidegradation as mandated in DRBC's Water Quality Standards)

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Programmatic Elements

Uses of bioassessment within overall water quality program	✓	problem identification (screening)
	✓	nonpoint source assessments
		monitoring the effectiveness of BMPs
	✓	ALU determinations/ambient monitoring
	✓	promulgated into state water quality standards as biocriteria
	✓	support of antidegradation
		evaluation of discharge permit conditions
		TMDL assessment and monitoring
		other:
Applicable monitoring designs	✓	targeted (i.e., sites selected for specific purpose) *(special projects and specific river basins or watersheds)*
	✓	fixed station (i.e., water quality monitoring stations) *(specific river basins or watersheds)*
		probabilistic by stream order/catchment area
		probabilistic by ecoregion, or statewide
		rotating basin
		other:

Stream Miles

Total miles* *(total miles of mainstem segment only, not including tributaries; determined using RF3 - Interstate river corridor is well-defined by river reaches, not watershed based)*	**200**
Total perennial miles	unknown
Total miles assessed for biology	**200**
fully supporting for 305(b)**	n/a
partially/non-supporting for 305(b)**	n/a
listed for 303(d)**	n/a
number of sites sampled *(on an annual basis)*	23
number of miles assessed per site***	~8.7

*DRBC is an Interstate Compact encompassing river miles in four states: Pennsylvania, New Jersey, New York and Delaware, and has not determined the number of total stream miles in the Basin. The Delaware River Basin watershed encompasses 13,539 square miles. Bioassessment and biocriteria activities are concentrated on a 200-mile non-tidal segment of the Delaware River and tributary boundary control points.

**Biocriteria are not currently used for the 305(b) report. Biocriteria were developed years ago, but the extent of their application is unknown.

***The number of miles assessed per site (~8.7) is very rough. DRBC's goal is to sample approximately 10 additional sites, thus reducing this number.

Aquatic Life Use (ALU) Designations and Decision-Making*

ALU designation basis	Single Aquatic Life Use and Fishery Based Uses	
ALU designations in state water quality standards	Two designations: The fishery-based designation is general, narrative, and defined by river zone. The single aquatic life use designation is macroinvertebrate criteria within DRBC's Special Protection Waters areas, and is defined for antidegradation purposes.	
Narrative Biocriteria in WQS	See definition of Existing Water Quality in Special Protection Waters (found in the 2001 workplan) for procedures used to support narrative biocriteria.*	
Numeric Biocriteria in WQS	See DRBC's *Administraive Manual – Part III, Water Quality Regulations*, Section 3.10.3 Stream Quality Objectives, Section A. Antidegradation of Waters, Table 1.*	
Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)	✓	assessment of aquatic resources
	✓	cause and effect determinations
		permitted discharges
		monitoring (e.g., improvements after mitigation)
	✓	watershed based management
Uses of bioassessment/ biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU	DRBC/NPS attempted to use existing criteria to define perceived problem areas. The existing criteria, as defined, could not distinguish anthropogenic versus natural measurable change. Program redesign is necessary.	

*Application of the existing system has been unsuccessful thus far due to the low priority given to biomonitoring. Program redesign recommendations were recently made to improve effectiveness and applicability of the criteria. Criteria for the entire non-tidal river are currently being updated, and a best-habitat based benthic IBI that might eventually be applied to future 305(b) assessments and the protection of existing water quality is under development. Additional data will be required, as well as a clear definition of how the criteria will be applied to the 305(b) process. Separate criteria will be required for the river, the tributaries, and for different levels of application and interpretation.

Reference Site/Condition Development

Number of reference sites	**23 total**	
Reference site determinations		site-specific
		paired watersheds
	✓	regional (aggregate of sites)
		professional judgment
	✓	other: aggregate sites in each river reach were used to define existing water quality for antidegradation purposes.**
Reference site criteria	In known high-quality waters numeric definition of Existing Water Quality provides a reference for comparison. Measurable Change determines departure from the reference condition.	
Characterization of reference sites within a regional context	✓	historical conditions
	✓	least disturbed sites
		gradient response
		professional judgment
		other:
Stream stratification within regional reference conditions *UD - tributaries are assessed according to methods used by states to facilitate comparability and data sharing*		ecoregions (or some aggregate)
		elevation
		stream type
		multivariate grouping
		jurisdictional (i.e., statewide)
		other:
Additional information	✓	reference sites linked to ALU *(not well linked)*
	✓	reference sites/condition referenced in water quality standards *(found in water quality standards)*
	✓	some reference sites represent acceptable human-induced conditions *(exceptional water quality was defined under 1980's New York City reservoir operations & dischargers)*

**The program's purpose is to protect the high quality of the river; therefore all sites sampled could be theoretically considered reference sites (the same sites are continually sampled each year and findings are compared to the original samples' data to determine if the quality has changed).

Field and Lab Methods

Assemblages assessed	✓	benthos *(<100 samples/year; single season, multiple sites)*
	✓	fish* *(<100 samples/year; single season, multiple sites)*
		periphyton
	✓	other: macrophytes *(<100 samples/year; single season, multiple sites)*
Benthos		
sampling gear		Surber, Hess, D-frame (500 - 600 micron mesh), BFN = Big-River Frame Net (custom rectangular net, bottom frame area .37 square meters, for Delaware River to 3ft deep, 4 fps, 500 micron mesh)
habitat selection		richest habitat, riffle/run (cobble), multihabitat
subsample size		tributaries - entire sample; river - 200 count
taxonomy		tributaries - family; river - genus
Habitat assessments		visual based, hydrogeomorphology, pebble counts, Pfankuch Flow characterization, Simon Channel Evolution Status; mostly performed with bioassessments, some performed independent of bioassessments
Quality assurance program elements		standard operating procedures, quality assurance plan, periodic meetings and training for biologists, sorting and taxonomic proficiency checks, specimen archival

*Some fish tissue data are collected as part of DRBC's monitoring program, but the work is contracted out to NJDEP and the Academy of Natural Sciences in Philadelphia. DRBC also makes use of PADEP, PA Fish and Boat Commission, and USGS NAWQA study data in water quality assessments.

The Delaware Estuary Program recently assembled an interstate committee to standardize fish advisories in interstate waters. DRBC has had trouble in the past with making use attainment calls based upon state fish advisories. Each state sampled different areas, species, and used different criteria. Conflicts among the different states' data arose when DRBC tried to pull everything together for the Delaware River assessment. DRBC's focus upon interstate coordination and cooperation to improve the process has subsequently increased.

Data Analysis and Interpretation

Data analysis tools and methods	✓	summary tables, illustrative graphs
		parametric ANOVAs
		multivariate analysis
	✓	biological metrics *(return single metrics - use endpoint for each single metric)*
		disturbance gradients
		other:
Multimetric thresholds		
transforming metrics into unitless scores		95th percentile of all sites
Evaluation of performance characteristics**	✓	repeat sampling
	✓	precision
	✓	sensitivity
	✓	bias
	✓	accuracy
Biological data		
Storage		STORET, SAS, MS Access and Excel
Retrieval and analysis		SAS

**See reports issued by the Academy of Natural Sciences (ANS) for an evaluation. ANS identified problems with performance characteristics depending on the level of data interpretation. A redesign of the program is necessary, including refinement of the biocriteria, and field and laboratory practices.